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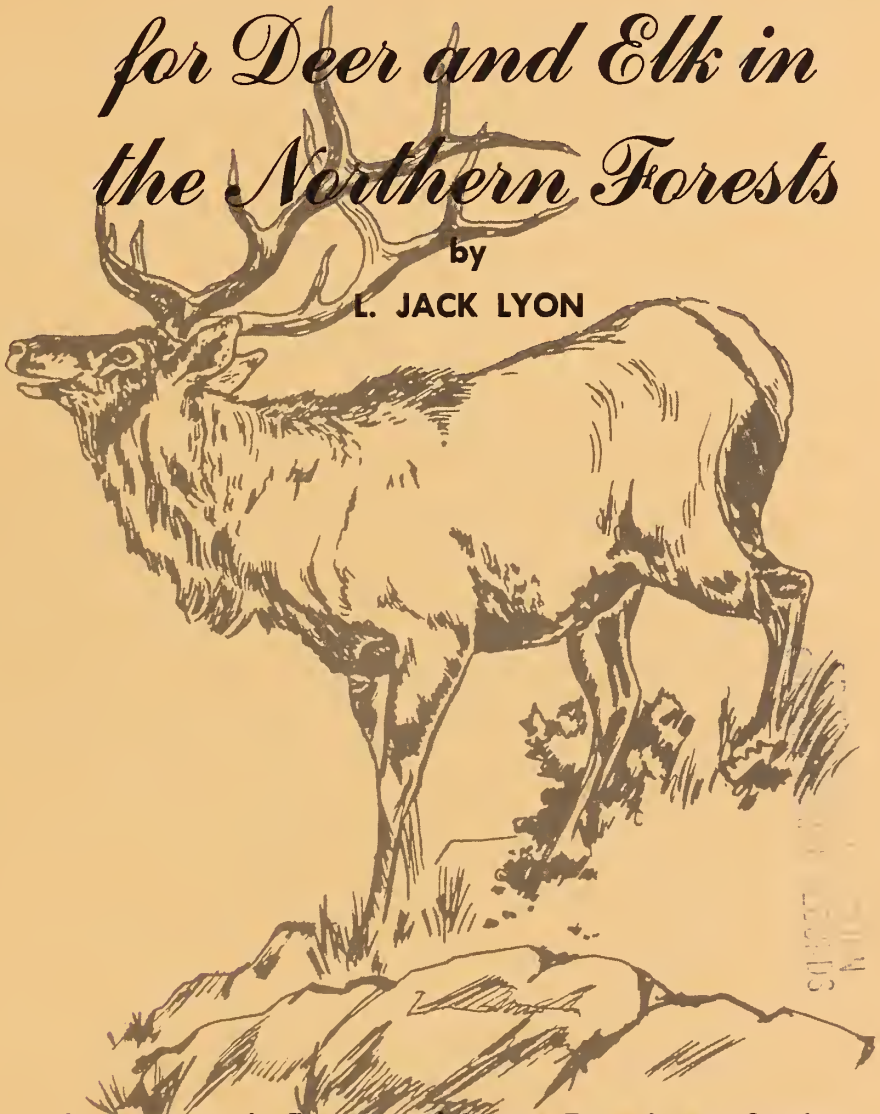
Problems of Habitat Management for Deer and Elk in the Northern Forests

by

L. JACK LYON



Intermountain Forest and Range Experiment Station
Forest Service
U.S. Department of Agriculture
Ogden, Utah

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Drawings by Lois Snyder

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INTRODUCTION

Montana west of the Continental Divide and Idaho north of the Salmon River is a vast region of timbered mountains containing nearly 27 million acres of forested land. Glacier National Park, 12 National Forests encompassing three large wilderness areas, and several million acres of private holdings combine to form a spectacular wildland area famous throughout the world for wildlife and outdoor recreation.

In this region, more than 300,000 hunting and fishing licenses are sold annually. Sportsmen kill 100,000 deer and elk every year, and there are open seasons on black and grizzly bears, moose, mountain goat, and bighorn sheep.[1] Hunters shoot turkeys and four species of woodland grouse on forested lands, and in the lakes and streams fishermen catch more than a dozen kinds of game fish including trout, salmon, and steelhead.

Wild animals, in addition, provide enjoyment and entertainment for thousands of tourists, photographers, hikers, campers, and just plain Sunday drivers. To Montana, to Idaho, and to the Nation, the abundance and diversity of wildlife in the northern Rocky Mountains is a heritage and a recreational resource without equal.

[1] *Data summarized from surveys and annual reports by the Idaho and Montana State Game Departments.*

The Problem

While the northern Rockies probably have more wildlife on a larger acreage of wildland than any part of the United States except Alaska, sheer abundance is not an unmixed blessing. Wild animal populations are not always compatible with timber production, grazing, or watershed protection; and complicated interactions among animals, vegetation, and soils often produce conflicts for which the land manager has no acceptable solution.

In certain areas, for example, food requirements of existing deer and elk herds far exceed the available supply of forage. Animals damage conifer plantations, cause serious soil erosion, and sometimes destroy their own range. Paradoxically, there are also areas in which the quality of elk hunting is dwindling; in some areas deer herds are barely adequate to sustain an annual harvest by sportsmen; in some streams fishing has been virtually destroyed—there are even a few places where the continued existence of one or more wildlife species is threatened. And, whether associated with overabundance or deficiency, an unhealthy condition in wildlife is usually symptomatic of conflict with other resource values.

Each year, as the demand for all forest products rises, the areas of conflict between wildlife and other forest uses will become increasingly serious. The wildlife heritage of the northern Rocky Mountains must be continued, but unless land management activities are well coordinated, it is virtually inevitable that the quality of the wildlife resource, and other resources as well, will be reduced.

The Solution

The key to wildlife abundance and diversity in the northern Rockies is good management of forest habitat. It is obvious that the number and variety of wild animals in any area is determined by the food and cover available, but it is sometimes less obvious that all habitat is not equally productive. Still less apparent is the fact that forest vegetation has a constantly changing value for wildlife because the vegetation is constantly changing. No forested area ever remains static.

Some changes, particularly those caused by fires, logging, and dam or highway construction, are sudden and obvious; but even in the absence of drastic alteration, the normal growth of trees and shrubs produces significant shifts in the plant composition of a forest. Whether drastic or subtle, these changes determine the amount of food and cover available and, consequently, the numbers and kinds of wild animals present. If wildlife habitat is to be managed successfully, the influence of such environmental alterations on animal populations must be understood. The wildlife heritage of the northern Rockies can be maintained and enhanced, but the private landholder and the public administrator both need substantiated facts on which they can base management decisions favoring wildlife.

The Need For Research

Research is needed to provide the background information for integrated management of wildlife and other forest resources. Many appropriate studies are already in progress. Game and fish departments of most western states, several federal agencies, universities in both Canada and the United States, and several lumber and power companies are studying problems of wildlife management on forested lands. Despite the number of sponsors for these investigations, however, the simple fact is that habitat research is years behind the current needs of land managers in this region. Moreover, the problems associated with fluctuating animal populations and the conduct of research on steep, inaccessible mountain slopes are complex and difficult. We cannot escape the conclusion that the total research effort, when compared to the amount of information needed and the difficulty of obtaining reliable data, seems far from adequate.

HABITAT PROBLEMS AND RESEARCH NEEDS

The following discussion of wildlife habitat problems and research needs in the northern Rocky Mountains is focused primarily on habitats of deer and elk. The important wildlife resources of this region are not, of course, limited to these big-game animals or even to animal species that furnish outdoor recreation and table fare for sportsmen. Nevertheless, two kinds of wildlife, the antlered game and fish, form the basic structure for a distinct and significant recreation industry in this region. And, although hunting and fishing are about equally important,[2] land animals are much more directly dependent on forest habitat and the way habitat is managed.

The reader should recognize that even though this presentation concentrates on problems of the habitat of deer and elk, many elements of forest habitat management apply equally to other game animals, to the forest grouse, and, in some degree, to fish. In a figurative sense, changes in forest habitat can be compared to the circular waves created by a pebble dropped in still water. As the distance from the source increases, the force of disturbance fades away, but at the same time more and more things are affected.

History of the Habitat

Historical references to wildlife and its habitat in the northern Rocky Mountains reveal conditions very different from those existing today. Before settlement, many North American big-game animals occupied the valleys, foothills, and plains, while the high-country forest was nearly devoid of game. In 1805, Lewis and Clark reported an abundance of elk, deer, bighorn sheep, antelope, grizzly bear, and buffalo from eastern Montana to the three forks of the Missouri River. When these explorers crossed Lolo Pass into the Lochsa drainage of Idaho, however, game was so scarce the men butchered their horses for food *(6)*. A half century later, the Montana pioneer Granville Stuart wrote that the Bitterroot Mountains were still a

> " . . . howling wilderness of yawning canyons and huge mountains, covered with a heavy growth of . . . timber, and affording a home to a few elk and large numbers of grouse, but of no earthly use for any thing but the mineral wealth they contain . . . " *(20)*.

Early settlers and prospectors killed many game animals for food, and as more people moved into the northern Rockies, deer and elk were severely overhunted. By 1900,

[2]*Records of numbers of trips to National Forests show that more effort is spent fishing than hunting (a ratio of about 1.6 fishing trips to each hunting trip (21). (Italic numbers in parentheses refer to numbered references in the "Literature Cited" section of this paper.) Hunters, however, spend more money on each trip so that the annual average expenditure of hunters and fishermen is roughly equal (12).*

the State Game Warden of Idaho reported elk becoming "scarcer every year," and in 1911 most of northern Idaho was closed to elk hunting *(11)*.

During this same period, the northern forests were almost continuously ravaged by fires. Indians and miners were notoriously careless with fire *(10)*, and early prospectors deliberately burned thousands of acres of timber to facilitate their search for gold *(9)*. Finally, between 1910 and 1920, a series of devastating wildfires burned more than 4.5 million acres of forest land west of the Continental Divide *(1)*.

All of these developments had direct and important effects on wildlife. Settlement and hunting drove deer and elk into the less desirable habitat of the mountain forests. There, fires killed some animals outright and destroyed large areas of productive game habitat. Finally, the ash-laden runoff from burned-over lands was deadly to fish.

In short, the tremendous changes caused by man and nature early in this century were almost all initially detrimental to wildlife.

In time, however, the forests recovered. Charred hillsides were transformed into grassy slopes and brushfields, and streams ran clear again. The postfire vegetation proved to be quite favorable for wildlife, and large areas of western Montana and northern Idaho became excellent game habitat. Numbers of deer and elk increased tremendously *(11)* as did grouse, rabbits, and small rodents. Following a short period of blackened devastation, then, many of these changes in the forest habitat proved highly beneficial to wildlife.

Over the past 4 decades, wildlife habitat in the northern Rockies has continued to change, and many recent developments have not been beneficial to game animals. Some wildlands have been lost to agriculture or urban expansion, water storage projects and highways have severely altered streams and bottomland habitat, and increasingly efficient fire suppression has permitted the uninterrupted development of mature forest vegetation on many thousands of acres. Overall, this latter factor has had the greatest single influence on game habitat and game numbers since the wildfires of 1910.

Ecology of the Habitat

In order to understand the importance of fire suppression, it is helpful to examine what happens on forest land following fires. The changes in vegetation, one plant community replacing another in successive steps, is a dramatic display of harmony in nature. A generalized schematic drawing of this succession is presented in figure 1.

In the years immediately following a severe fire, blackened stumps and burned snags dominate a barren landscape, but this situation is transitory (figure 2). As early as the first year, some seedling plants may appear, and plants not killed by the fire begin to revive. Before many years have passed, forbs and grasses cover the area (figure 3).

Eventually, shrubs begin to appear. Some come from seeds or rootstocks that survived the fire (figure 4) and others grow from seed carried by wind or animals. As these plants increase in size, they crowd out smaller vegetation. The resulting brushfield (figure 5), if the shrub species are palatable, provides good forage for big-game animals. Normally, this is also the most productive habitat stage for small-game animals.

Shrub dominance in the northern forest region may continue from 10 to 100 years, but shrubs are eventually displaced by trees in the same way grasses and forbs were displaced by shrubs (figure 6). The end product of plant succession in the northern forests is a mature stand of trees *(5)*. In the shade of such a stand, ground vegetation is either lacking or thinly distributed (figure 7). Almost without exception, this stage is the least desirable for wildlife.

Figure 1 represents only one version of an infinite number of variations on forest succession. On some sites, lack of a seed source for trees may prolong the shrub stage for hundreds of years. On other sites, conifer reproduction may be so dense that no other vegetation ever appears. Under certain circumstances, the forb and grass stage, or the shrub stage, may be missing entirely. The only thing consistent about forest vegetation is that it changes constantly.

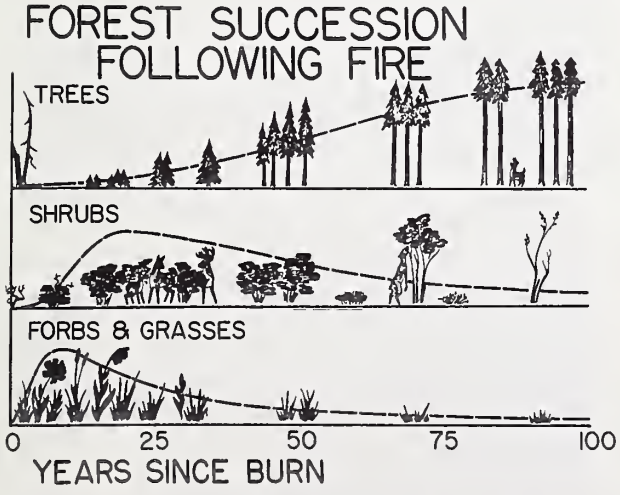

Figure 1.—Schematic description of forest succession following fires.

Figure 2.—Shortly after a forest fire, the burned area appears almost devoid of any form of plant life. (Bitterroot National Forest, Montana.)

Figure 3.—A few years after the fire, grasses and forbs are dominant. Shrubs have not yet begun to appear on this site. (Bitterroot National Forest, Montana.)

Figure 4.—Some shrubs recover very quickly following fire. This willow sprouted from unburned rootstocks 1 year after a burn. (Sawtooth National Forest, Idaho.)

Figure 5.—On this winter range shrubs are dominant today, but seedling trees can be found throughout the area. (Clearwater National Forest, Idaho.)

Figure 6.—Trees eventually replace shrubs. In this mixed stand, trees are not yet dominant, but in 5 to 10 years shade will begin to inhibit growth of the shrub understory. (Lolo National Forest, Montana.)

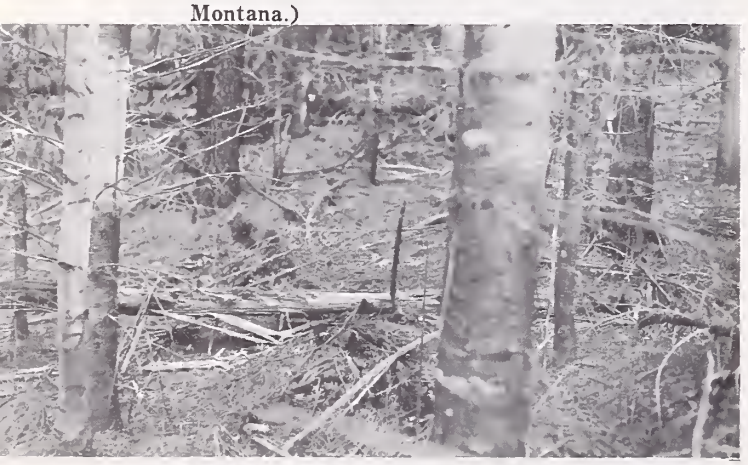

Figure 7.—This is a relatively young stand of timber, but shade from the tree canopy has already eliminated grasses, forbs, and shrubs from the understory. (Clearwater National Forest, Idaho.)

The forest succession pattern described here represents a natural course of events. And since nothing in nature is static, vast areas of brush range in Montana and Idaho are today reverting to forest. Many of the browse ranges created by fires and logging a half century ago are disappearing under a closed canopy of trees. Overuse of the remaining habitat by big-game animals has created a variety of land-management problems. In some areas, deer starve or damage timber plantations because they lack sufficient forage, and in other areas soil erosion and compaction are caused by large numbers of elk concentrating on limited ranges. More important, perhaps, is the fact that the loss of game habitat has been followed by a decline in game numbers. The great elk herds of the Selway-Bitterroot Wilderness and the Bob Marshall Wilderness are striking examples: despite comparatively light hunting and lack of competition with livestock for range and space, both herds are notably smaller today than they were 20 years ago *(13, 19)*. Deer and elk herds outside the wilderness areas have followed much the same pattern *(8)*.

Fortunately, the trend is not all unfavorable. As old wildlife ranges disappear some new habitat is created each year. Uncontrolled wildfires are practically a thing of the past, but clearcut logging, as practiced by most timber managers in the northern Rockies, starts a plant succession pattern very much like that pictured in figure 1. Artificial planting is sometimes substituted for natural seeding, but unless timber management is very intensive, plant growth on a logged-over site will cycle through stages dominated, first, by forbs and grasses (figure 8), then shrubs, and finally by trees. And again, almost without exception, the earlier stages of succession support more wildlife than the mature forest. If the majority of plants in the shrub stages provide food as well as cover, the increases in numbers of deer, elk, and small game can be spectacular.

One point should be emphasized: neither logging nor wildfire is always dependable in

Figure 8. A clearcut logging area. Note the similarities between this area and the wildfire area pictured in figure 3. (Clearwater National Forest, Idaho.)

producing good wildlife ranges. More often than not, the plants that flourish after tree removal are only partially suitable as forage and cover. Clearcut logging, however, does have one vital advantage over wildfire: following logging, it is theoretically possible to control slash disposal or site preparation to favor desirable plants and create high-quality game range. Not all timber sites, of course, are capable of producing game range, and not all game-habitat areas are managed for timber production. Nevertheless, it seems logical that the land areas being logged each year could provide habitat for more wildlife than we now have. The missing factor is the combination of knowledge and techniques for managing vegetation so as to produce a superior environment for animals.

Specific Problems

In concept, the management of forest vegetation to provide big-game habitat seems relatively simple. Both deer and elk consume leaves and twigs of woody shrubs as a normal part of their diet, and we already know that removal of trees by logging, fire, or any other method usually produces shrubs. Big-game food and cover requirements, however, are not limited to shrubs and at the same time are restrictive even within this plant group. Many of the common woody plants, such as ninebark and oceanspray, are unpalatable. Other species are eaten only in small quantities. Even highly palatable plants, such as serviceberry and redstem ceanothus, are more desirable in mixtures with other shrubs than in pure stands. And, finally, all big-game animals seem to require a certain amount of cover in and adjacent to feeding areas.

The management problem is further complicated by seasonal variations in food habits and range requirements. Deer and elk seek grasses and forbs in the spring and summer, and many herds migrate each year from a lowland winter range to a high altitude summer environment. Thus, habitat requirements in the summer may be physiologically as well as geographically remote from habitat requirements of animals in winter.

Seasonal differences in game ranges provide a logical division for discussion—even though separation of summer and winter ranges is more easily accomplished on paper than in the forest. For the purposes of this presentation "winter range" includes heavily used areas in which animals are concentrated

for relatively short periods in winter and early spring. Forage on these areas is mostly woody browse because it must be available despite deep snows. Shelter from wind and cold is also important. "Summer range," on the other hand, must produce a wide variety of herbaceous and woody forage for relatively long periods of the year, but shelter is less of a consideration except as needed to protect young animals from predation and to provide adults with cover during the hunting season. An obvious extension of these definitions suggests that it may be necessary to dedicate limited wintering areas to permanent management for big game while summer ranges will probably be managed for many interrelated uses.

Winter Ranges

Almost without exception, wildlife biologists in Montana and Idaho consider winter range to be the weakest part of the big-game environment. Summer ranges for both deer and elk are considerably larger than wintering areas, and animals that use only a portion of available summer forage are concentrated on winter ranges that have only limited capacity to support big game. There are, in fact, very few winter ranges in the northern Rockies that are not occasionally overused. In severe winters, certain areas may be so crowded with animals that the vegetation is destroyed and starvation strikes down a significant portion of the herd.

Figure 9.—Severe browsing of chokecherry. Plants that have been so heavily utilized are often incapable of producing new growth. (Montana Game Department photograph.)

The determining and complicating factor is the severity of winter weather. In a normally cold winter, with average or light snowfall, forage may be adequate to sustain herds with little damage to plants and only minor losses by starvation. In a severe winter, however, all forage but tall woody shrubs is buried, and deep snows restrict animals to a few small areas where range damage and starvation become excessive. If the damage and associated death losses are to be prevented, new methods for managing winter range, particularly concentration areas, must be discovered. We need to determine how to rehabilitate overused ranges, how to maintain browse ranges under stabilized but constant use, and how to create new winter ranges.

Rehabilitation

In many parts of Montana and Idaho, repeated overuse of browse plants has produced disastrous results. The best forage plants, such as redstem ceanothus and serviceberry, have been literally "beat into the ground" by repeated browsing (figure 9). These plants either die or have so little vigor that they simply do not produce new stems. Other species such as willow and mountain maple grow so tall that normal animals cannot reach the edible twigs (figure 10) and only the largest of bull elk is able to bend the stems down by walking over the plant. Rehabilitation therefore presents three problems: (1) replacing dead plants,

Figure 10.—Willow and maple may grow to 20 feet or more. When this occurs, forage is almost totally unavailable to wildlife. (Clearwater National Forest, Idaho.)

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(2) rehabilitating weak plants, and (3) reducing the height of plants too tall to provide winter food.

1. One obvious means of replacing dead vegetation on overused winter ranges is direct planting of native or exotic shrubs. In some areas, a considerable amount of work has already been done in selecting adaptable species and developing planting methods and equipment. Artificial revegetation, however, is always expensive and usually is feasible only on level ground *(7)*. We must develop more methods for rehabilitating steep slopes and inaccessible areas in the northern Rockies. To do this, we must find out how much viable seed is already lying dormant on the ground and how to revitalize plants so they will produce seed. It may even be possible to distribute seed from helicopters or airplanes on suitable sites. The most important point, however, is that we must determine how to provide site conditions suitable for germination of seed and for survival of seedling plants.

2. The second rehabilitation problem, restoring the vigor of decadent plants, has occasionally been solved by decreasing the browsing pressure. A mild winter or herd reduction often accomplishes the desired result; but just as often it does not. For example, some serviceberry plants along the flats above the Kootenai River have been protected by deerproof exclosures for 10 years—but have shown no response at all to the relief from browsing pressure. Rehabilitation of these plants will require some other technique.

Surprisingly, one method that might succeed requires even further mutilation of low-vigor plants. We already know that many healthy plants respond to complete destruction of the crown with vigorous shoot growth and basal sprouting. Possibly, this reaction could be used in rehabilitating low-vigor plants. Potential methods of treatment might include cutting, crushing, burning, or spraying with herbicides. However, some species of shrubs do not resprout. Would fertilization benefit such plants, or are there chemical growth regulators that might stimulate a response? Before these

questions can be answered, we need to understand the physiology of both healthy and low-vigor plants and the combinations of circumstances and treatments that cause extreme decadence.

3. Finally, there are browse ranges, particularly in Idaho, where the height and density of vegetation should be reduced. Total forage production is actually quite high in these areas, but most of the growth is out of reach of animals. Wildlife biologists in California have reported successful reduction of chamise brushlands using fire, bulldozers, and chemicals *(2)*, but similar testing has only begun in the northern Rockies. One recent investigation, for example, was conducted by an ecologist of the Intermountain Experiment Station on the Clearwater National Forest in Idaho *(15)*. There, the herbicides tested did produce crown-kill and subsequent basal sprouting on several browse species. However, the most desirable browse plant tested also proved to be the most sensitive to chemicals. Redstem ceanothus was invariably killed by applications that gave highly satisfactory results on willow and maple.

Tests using fire as a tool to reduce tall vegetation are also in progress in northern Idaho, but no results are yet available. In the initial phases of study a south-facing hillside was burned off in spring when snow

still covered the ridgetops. Crown-kill of serviceberry, willow, and redstem ceanothus appeared to be good; but until resprouting of individual plants is evaluated, until the technique is tested on a wide variety of sites, and until it is possible to judge potential long-term influence of burning on the site, the use of fire must be considered experimental.

Maintenance

Possibly the most important long-range problem of winter range management is maintaining good ranges in continuous production. Browse plants seem to age, as all other living things do, and on some winter ranges the process is accelerated by repeated overuse by animals. In addition to surviving an annual removal of twigs, plants must compete with unpalatable shrubs and with trees for light, water, and nutrients. Management techniques are needed to assure continuous and vigorous forage production despite these hindrances.

Several studies have already shown that plant vigor and production are actually increased by moderate browsing. For most of the important browse species, the accepted tolerance to browsing is about 50 to 65 percent of annual production. It is nearly impossible, however, to manage game herds so that this level of utilization is attained but not exceeded. Thus, in a severe winter, 80- to 100-percent utilization is sometimes recorded. We need to determine how many times a plant can tolerate such abuse without losing vigor and what techniques can be used to restore declining production. We must determine how to prevent premature decadence in heavily browsed plants, and we must learn how reproduction of palatable browse species can be encouraged for continuous natural replacement of aging plants. At the same time, we must discover techniques to prevent unpalatable shrubs and trees from occupying winter range sites. Long-term maintenance of small but permanent winter-range browse fields will, in many areas, be the only method by which we can assure stability of game herds occupying a large, transitory summer range.

One important management tool that needs more investigation is prescribed fire. We already know that conifers can be temporarily or even permanently removed by repeated burning. However, the other post-fire responses of vegetation have been only partially investigated *(14, 17)*, and the use of prescribed fire without a greater background of research could be foolhardy. We do not know, for example, whether repeated fires might favor undesirable browse species or cause erosion problems, whether some burning patterns will provide better growth response than others, or, in fact, whether other treatments, such as spraying with conifer-specific herbicides or harvesting small conifers for Christmas trees might not be more efficient. In addition, we need to know how often burning or other treatments would be necessary and the best time of year to do this work.

Creation

A third group of winter range problems is associated with the need to create new winter ranges where old ranges have disappeared or where none ever existed. As the seemingly inevitable construction of campgrounds, four-lane highways, and water impoundments destroys existing winter ranges, we must either create new ranges or sacrifice a part of the wildlife resource. New winter-range areas might also be needed to reduce the utilization of existing but limited forage or to relieve animal use on areas better suited to uses other than winter range.

Most of the research needed to provide background information for rehabilitation and maintenance of browse plants will also be valuable in creating new ranges. Techniques for removing trees and favoring palatable browse plants, in particular, would be applicable. Some questions, however, are peculiar to this problem alone. The most basic question, perhaps, is simply defining the site and vegetation characteristics that determine winter range. Game managers already have techniques for measuring the amount of use by animals and thereby judging the importance of existing winter ranges. The land manager, however, needs tech-

niques by which he can judge the potential values of an area that is not winter range. After this evaluation has been made, he will still be faced with the problem of achieving conversion.

It seems logical that any area that can be converted to winter range would already be winter range unless (1) it is covered by a mature stand of timber, (2) all the shrubs on the site are unpalatable or, (3) habitual migration patterns are so firmly established that animals simply do not appear in what might otherwise be a satisfactory wintering area.

The obvious answer in the first case is logging, and this in fact may be the single most satisfactory method available for creating new winter ranges. However, it is also possible that removing the timber overstory will only produce unpalatable shrubs. In this case, we need to discover management techniques for removing existing undesirable plants and replacing them with browse species not even present in the existing vegetation. Surprisingly, it may already be possible to attain this objective on some sites without resort to direct planting. We already know that seeds of both redstem ceanothus and evergreen ceanothus lie dormant in the soil for many years after the plants have died. We also know that burning usually creates the soil and site conditions required for germination and production of new plants. Once we determine how to identify sites on which sufficient ceanothus seed is already present, prescribed fire could become a very useful tool in the creation of big-game winter ranges. Intensive studies of the life histories and reproductive mechanisms of other browse species will eventually give us the management tools necessary to create winter ranges with desirable combinations of plant species on virtually any suitable site.

A potential for manipulating animal movement instead of forest vegetation is suggested because deer and elk are conservative and traditional in their habits *(16)*. Animals learn migratory routes and hereditary ranges early in life, and they may suffer chronic malnutrition on these traditional ranges before they seek a better environment. Thus, techniques for influencing animal movement would be valuable in preventing overutilization, in distributing utilization evenly, and, possibly, in attracting animals to previously unused range areas.

In recent years, research workers in both Idaho and Washington have conducted experiments aimed at influencing animal movement. In one project, biologists of the Idaho State Department of Fish and Game and the Idaho Cooperative Wildlife Research Unit distributed salt blocks on the slopes above the Lochsa and Selway Rivers *(4, 22)* in an attempt to regulate elk use of winter ranges. The salt was heavily used, but there was no clear indication that either time of migration or rate of herd movement was changed. In the Washington experiment, Game Department hayfields proved highly attractive to elk after commercial fertilizers had been applied *(3)*. Initially, the fertilized fields were sufficiently attractive to keep elk from damaging adjacent private hayfields. However, when the local ranchers applied fertilizers to increase yields, elk resumed traditional feeding patterns.[3]

Obviously, discovering techniques for influencing animal movement is not going to be easy. Both of these studies demonstrate the degree that elk will go in their own bullheaded way in the face of efforts to improve land management. However, the fact that animals did react to both salting and fertilizer treatments is some measure of success. Future research along these and other lines should produce methods capable of influencing the most stubborn game animals.

Summer Ranges

Most of the winter range problems already discussed are applicable to big-game habitat any time of the year. Summer habitat, however, does present some management challenges that have no winter counterpart. For example, on summer ranges, many plant species in addition to woody shrubs must be

[3]*Personal conversation with E. Reade Brown. 1962.*

considered in research studies and management planning. More important is the fact that summer ranges in the northern Rockies generally include timber sites. This means that very few summer range areas could be managed, even on a restricted basis, for the primary benefit of wildlife. It also suggests that research should be concentrated on developing coordination between game management and timber production and on reducing existing conflicts in the use of game and timber resources.

Coordination

Much of the research needed to guide summer range habitat management is related to the fact that we lack specific information about the vegetation that develops following fires and various types of logging. We know that some game forage usually develops when overstory trees are removed, and we know that logging is a common and commercially rewarding method of removing overstory trees. These two facts could lead to the conclusion that logging is a successful technique of habitat management — except that results very often fall far short of the obvious potential.

In order to realize this potential, we must learn which plants recover after a logging operation, the amount of forage they produce, and the length of time they will provide food for wildlife. These facts are essential. For as the new timber crop matures, the logged-over sites will lose their value to big game, and until we can predict production and longevity of transitory ranges it will not be possible to promote stable herd levels by management.

With the basic descriptive information as a foundation, we can then determine why some plants respond better than others and, most important, how to favor those species with the greatest utility for wildlife. Site preparation for a new timber crop can include a wide variety of treatments ranging from scalping of small spots in which nursery stock is planted through broadcast burning of slash and natural seeding from uncut trees. The nearly infinite variety of these treatments offers a tremendous potential for managing transitory range for the benefit of wildlife within basic silvicultural objectives. Fire, in particular, may prove to be an important tool simply because so many different degrees of treatment can be applied using essentially the same technique.

The significance of logging as a potential habitat management technique should not be passed over lightly. In the absence of wildfires, the only significant recurring disturbance of mature forests will be caused by logging and, except for the maintenance of winter-range areas dedicated primarily for wildlife, this single activity will have major importance in determining big-game numbers in the northern forests.

Coordination of timber production and big-game management does not appear to be impossible. Instead, it is a desirable objective and an opportunity for the land manager to obtain optimum yields of both resources from forested lands. What is missing is the knowledge required to accomplish the job effectively.

Conflicts

If optimum yield of both timber and game is to be achieved, several areas of conflict must also be reduced. Big-game damage to conifer reproduction, for example, must be evaluated, and some solution more sophisticated than chemical repellents or herd reduction must be discovered. Since forage on summer ranges is usually adequate, it seems logical that deer do not need to eat pine seedlings to survive. Yet deer do sample young pines in about the same way humans eat pickles. We should determine the nutritional role played by conifers in the animal diet and examine methods of supplying physiological condiment with less valuable vegetation.

There are several ways in which research might contribute to solution of this problem. Seeded forage plants, for example, could be tested to see whether they will relieve browsing pressure on small conifers. Research designed to determine why deer feed on small conifers would be another useful approach. Such investigations might reveal a dietary deficiency that could be relieved

with properly prepared food supplements or salt blocks.

In addition, the potential influence of silvicultural thinning on big-game feeding habits should be explored. We know that thinning of pole-size timber stands often causes a resurgence of growth in suppressed understory vegetation as well as in selected crop trees. Properly timed, such a thinning might help to relieve browsing pressure on nearby, newly planted timber stands. Finally, deer and elk might be attracted from area to area over a period of years by systematic scheduling of logging operations. In all of these investigations, we must determine the composition of the vegetation which occurs naturally and, if this is not the best combination, discover methods of favoring desirable forage species.

Another area of continuing conflict is the controversy regarding the application of pesticides for forest insect control, particularly by aerial spraying. Surveys by the U. S. Fish and Wildlife Service have shown residues of common insecticides in the body tissues of Montana deer *(18)*, and poisoning of fish and grouse have been reported. The effect of insecticide residues on wildlife populations, and on humans eating wild meat, is unknown. We do not know how much time is required for the forest environment to eliminate chemical residues, and research on breakdown rates of various chemical compounds is just beginning.

Broad-scale research programs involving entomologists and wildlife and public health scientists from several related federal and state agencies have been initiated to study insecticide influences, but this is only part of the problem. The herbicides used to control weedy vegetation along roadsides, the fungicides used to control white pine blister rust, and the poisons used to reduce rodent populations in timber plantations are all pesticides, and we know very little about their lingering effects in the forest environment. Progress is being made, but these are complicated questions and much work will be required before definitive answers are available.

Conclusion

The intention in this paper has been to review some of the problems of wildlife habitat management in the northern Rockies and to point out the important questions that must be answered before land managers can provide the consideration wildlife should receive in multiple use planning. Since 1900, we have witnessed the development of hundreds of thousands of acres of browse range on lands where forests were destroyed by disastrous wildfires. We have seen the explosive expansion of big-game populations into this newly created habitat — and we have enjoyed a resulting game abundance greater than any in the recorded history of the northern Rockies. More recently, we have observed a deterioration of wildlife environment as the inevitable development of forest vegetation progresses toward mature plant communities. Productive wildlife habitat is disappearing under a closed canopy of trees, some browse ranges are overused or too tall for animals, and much of the game habitat currently being created is an unplanned byproduct of logging. Throughout the northern Rockies, a general deterioration of wildlife habitat and an increasing demand on other forest resources has caused land management problems that include declining game populations, conflict with timber management and grazing, and damage to soil and vegetation.

Wildlife will continue to be one of the significant forest resources of the northern Rockies, but to obtain the best use of all resources, some forest vegetation should be managed for specific wildlife values. The land manager cannot simply accept the habitat produced by logging any more than he can permit forest fires to rage unchecked in the hope that game habitat will be produced. In order to maintain and enhance the wildlife resources of western Montana and northern Idaho, research must discover management techniques that will maintain existing browse fields in permanent production, that will replace old ranges which are disappearing, and will integrate wildlife production into overall forest management planning.

The discussion here has been confined primarily to big-game habitat problems, but this does not relegate other wildlife to a less important status. The research needed to provide habitat management tools for deer and elk will be equally applicable to the habitat of other forest game and, indirectly, to fish.

Continuation of the wildlife heritage of the northern Rockies in competition with other increasing demands on forest lands is not an impossible objective. We are facing, rather, a challenge to the ingenuity of the land manager and the ability of all men to live in harmony with the forest environment.

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